



## UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

### REGION VIII

999 18th STREET - SUITE 500  
DENVER, COLORADO 80202-2466

## RADIOACTIVE TRACER SURVEY

January 22, 1999

### PURPOSE:

The purpose of this document is to provide a guideline for the acquisition of a radioactive tracer survey (RATS), a procedure that may be used to determine whether injected fluids may migrate vertically outside the casing after injection. This guidance may be used to develop a well-specific survey plan that accounts for specific well construction and operation considerations. Prior approval of planned RATS procedures by EPA is strongly recommended.

Radioactive Tracer Survey results must be documented with service company and other appropriate log records and/or charts, and the test should be witnessed by an EPA inspector. Arrangements may be made by contacting EPA Region 8 Underground Injection Control (UIC) offices using the EPA toll-free number 1-800-227-8917 (ask for extension 6155 or 6137).

### RECORDING GUIDELINES

The logging must be done while the well is **injecting at normal injection pressure and rate**. The pressure and rate should be brought to equilibrium conditions prior to conducting the survey.

The survey tool must **include a collar locator** for depth control, an injector, and two detectors (one above and one below the injector).

Vertical **log scale** may be one inch, two inches, or five inches per 100 feet.

The Gamma Ray log may be run at up to 60 feet per minute (ft/min) at a time constant (TC) of one second, or up to 30 ft/min at a TC of 2 seconds, or up to 15 ft/min at a TC of 4 seconds. **The logging speed and time constant used must be indicated on the log heading.**

The **horizontal log scale** must be recorded in standard API Units (or in counts per second).

The **gamma ray (GR) sensitivity** must be set so that the tracer will be obvious when detected and will not be confused with normal "hot spots" in the logged formations (e.g., the gamma ray sensitivity set so that the lithology can be correlated by recording a "base log").

**Record the beginning and ending clock times** of each log pass.

**Record the injection pressure and rate** during each log pass.

**Record the volume of fluid injected BETWEEN** log passes.

**Record the type, volume, and concentration** of each tracer "slug" used.

**Show the percentage of fluid loss** across the perforated interval(s).

## **RECOMMENDED PROCEDURE:**

With the GR sensitivity set for the lithologic correlation log as outlined above, run one “base log” from the injection zone to at least 500 feet above the injection zone (or at least 200 feet above the top of the confining zone).

Commence operating the well at normal operating injection pressure and rate, and continue to do so until the pressure and rate become stabilized.

Set the tool so that the injector is positioned just below the tubing packer and inject a “slug” of tracer.

Reduce the GR sensitivity enough to keep the entire slug of the tracer radiation within the width of the chart paper (horizontal scale). To do this, a non-recorded pass through the slug may be run.

Drop tool to an appropriate depth below the slug and record Log Pass #1. Log to above the upper interface until the radiation level returns to the same level as below the slug. Drop tool to the appropriate depth below the slug and record Log Pass # 2 in the same manner as #1.

Repeat log passes process until the tracer slug strength dissipates to one tenth (1/10) of original strength (on Log Pass #1). At this point, reset (increase) the GR sensitivity to the same settings used for the base log, and repeat log from the injection zone to at least 500 feet above the injection zone (or at least 200 feet above the top of the confining zone).

Drop tool to an appropriate depth below the slug, reset (reduce) the GR sensitivity to that used for logging (same setting as Log Pass #1), and record a log pass up to the packer. Repeat this logging process until the tracer slug is gone or has completely stopped. Then reset (increase) the GR sensitivity back to the base log setting and make a final logging pass from the injection zone to at least 500 feet above the injection zone (or at least 200 feet above the top of the confining zone). This final pass should show a close similarity to the pre-test base log response. NOTE: More than one pass may be shown on a log segment as long as each separate GR curve with its corresponding collar locator are distinguishable, otherwise record each pass on a separate log segment.

Drop and set the tool at the depth where the bottom detector is just above the uppermost perforation and inject a slug of tracer (the tool remains stationary for this logging record). As the slug moves past the bottom detector, the log trace should show an increase in the GR response. Hold the tool at this depth while pumping at the equilibrium pressure and rate.

## **SUBMITTING THE RESULTS:**

An interpretation of the logging results must be supplied when submitting the data for EPA approval. The interpretation must include a fluid loss profile across the perforations, in increments of at least 25%

Include a schematic diagram of the well construction on or with the log. The diagram should show the casing diameters and depths, tubing diameter and depth, perforated interval, any open hole intervals, tot depth or plugged back total depth, and the location of the tool when the slug was injected. Also, indicate with arrows the pathway(s) the tracer slug appears to have gone.